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ABSTRACT

Residential areas with low property tax rates are more desirable than those with high tax rates, and school districts that have a high rate of expenditure per pupil are more attractive to parents than those with low rates of expenditure. For these reasons, the financial characteristics of a school district influence the value of housing in the district. Changes in the fiscal conditions of districts brought about through school finance reform will lead to changes in the housing values relative to other districts. These capitalization effects have three implications for the analysis of school finance systems. First, to the extent that housing prices adjust perfectly, compensating residents of low wealth districts for their school finance disadvantages, the system is not characterized by horizontal inequity despite earlier assumptions. Second, since the well-being of households is relative to the fiscal conditions in several neighboring districts, all of those districts must be analyzed to determine the impact of alternative school finance systems on vertical equity. Finally, recapitalization effects are likely to influence the cost of reform to the state. That is, state equalization aid will lead to changes in the relative housing values and tax bases of the districts affected by the aid. (Author/PGD)

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PREFACE

This Note was prepared for the Ford Foundation in response to the growing impression among some analysts and legislators that capitalization effects--that is, changes in land values--will be an important outcome of school finance reform. To date, recognition of that importance has not reflected a clear understanding of what exactly capitalization might or might not mean with respect to school finance issues. It is hoped that this Note begins to clarify the connection.

School finance reform is a multifaceted undertaking. Courts and legislatures devise complex policy responses to equally complex perceived problems. The discussion presented here should be seen as a part of a much broader program of policy analysis. Other Rand contributions to the analysis of school finance issues include:

Alexander, A. J., *Teachers, Salaries, and School District Expenditures*, R-1588-FF, 1974.

Alexander, A. J., *Inequality in California School Finance: Dimensions, Sources, Remedies*, R-1440-FF, 1975.

Barro, S. M. and S. J. Carroll, *Budget Allocation by School Districts: An Analysis of Spending for Teachers and Other Resources*, R-1797-NIE, 1975.

Carroll, S. J., *The Search for Equity in School Finance: Summary and Conclusions*, R-2420-1-NIE, 1979.

Carroll, S. J., *The Search for Equity in School Finance: Results from Five States*, R-2348-NIE, 1979.

Park, R. E. and S. J. Carroll, *The Search for Equity in School Finance: Michigan School District Response to a Guaranteed Tax Base*, R-2393-NIE/HEW, 1979.

Some of the discussion presented in this Note will also appear in the *Journal of Educational Finance*, Vol. 5, No. 2, 1979.

SUMMARY

The financial characteristics of a school district, the tax rate and level of expenditures per-pupil, influence the value of housing in that district. This contention is strongly supported by theoretical and empirical analysis.

Theory tells us that districts characterized by high expenditures and low tax rates will be more desirable as residential locations than other less favored districts, and that, therefore, houses in the advantaged districts will command a premium price. A substantial body of empirical evidence has appeared in the econometric literature which confirms this theoretical hypothesis. Fiscal characteristics do, in fact, affect housing prices, especially within large metropolitan areas.

Given this evidence it is easy, and probably justifiable to assume that changes in the relative fiscal conditions of districts, that is school finance reform, will also change relative housing values across districts.

These capitalization effects have three implications for the analysis of school finance systems. First, to the extent that housing prices adjust perfectly so as to compensate the residents of low wealth districts completely for their school finance disadvantages, the system is not characterized by horizontal inequity. It is very difficult to determine whether prices adjust completely, but once we take capitalization into account we can no longer accept the imperfect association between high taxes and high expenditures as *prima facie* evidence of horizontal inequity.

Second, if differences in fiscal advantage are capitalized, then the well-being of a class of households is determined by the relative fiscal conditions of all the school districts in which such households may choose to live. Therefore, in order to assess the impact of alternative school finance systems on vertical equity, we must undertake a careful analysis of the entire joint distribution of income classes and fiscal advantages across school districts. Broad generalizations such as "the poor tend to live in central cities" lead to very incorrect conclusions.

Finally, recapitalization effects are likely to influence the cost of reform to the state. Since the greatest increases in property values are experienced in the lowest wealth districts, and the greatest decreases in high wealth districts, underlying tax base disparities are likely to be reduced. We estimate that these effects might reduce the cost of a tax base equalizing reform by up to 25 percent.

CONCLUSIONS

School finance reform is seen to have two objectives: taxpayer equity and expenditure equity. The analysis presented in this note suggests that the issue of taxpayer inequity is not as clear-cut as some analysts and courts appear to have believed. The effect should be to raise the importance of issues in expenditure equity and the effect of school finance systems on children as opposed to taxpayers.

Furthermore, we have identified the source of taxpayer inequity to be barriers to residential mobility and perfect price adjustment. Future school finance research should direct some attention to these issues.

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I. INTRODUCTION

Any major reform of school finance will almost certainly bring about changes in property values. This Note explains why this effect should occur, reports the econometric evidence that it will occur and discusses the implications of the phenomenon for the analysis of reform proposals.

The theory of school finance capitalization is simple. Households with children prefer to live in communities with good schools. The best schools are found in districts which spend the most per pupil. If housing in these districts is scarce, the existing houses will command a premium price. This premium is termed the capitalization of expenditures. Likewise, all households prefer to live in communities where taxes are low, and scarce housing in such communities will also command a premium. Thus the capitalization of taxes. Therefore, the price of housing in any given school district will depend, in part, on the level of school expenditures and local tax rates. When these fiscal characteristics are changed by legislative fiat the prices of housing will also change.

Most of the discussion presented in this Note will refer to owner-occupied housing. This limitation leaves our analysis incomplete in an important respect, however; the decision to exclude consideration of renter-occupied housing was not arbitrary, but reflects the fact that the economic literature on this subject has given rental housing very spotty attention. The problem is that if we wish to model the behavior of renters or of rental markets, we must also model the behavior of landlords, and the objectives of this new set of actors complicate the analytical picture considerably. Unfortunately we must simply point out that whatever might be the effects of capitalization on owner-occupants, a rather different set of effects might be realized by renters.

This Note will begin with a discussion of why capitalization effects should be taken into serious consideration in the analysis of school finance systems. We will then present a review of the empirical literature on the topic leading to the conclusion that school finance capitalization does in fact take place. The next

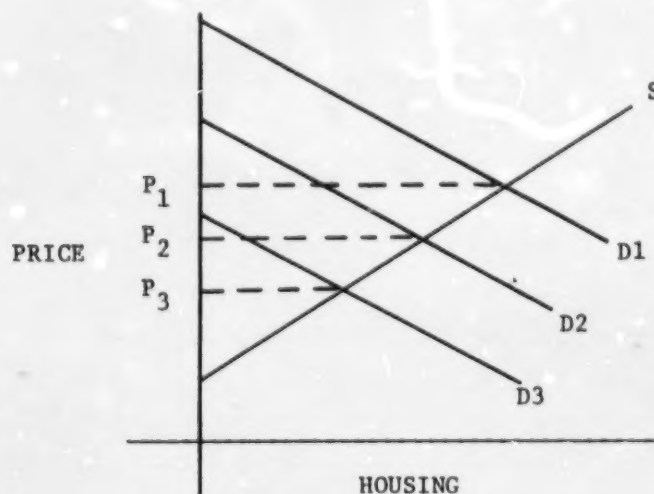
section will report some new empirical results developed in the course of this study which indicate that it is not taxes and expenditures per se which are capitalized, but more fundamental fiscal differences among communities. The final sections will discuss several ways in which capitalization effects influence the analysis of school finance systems. Specifically, we will assess relationships between capitalization and the equity of school finance systems and the likely impact of recapitalization on the aggregate direct cost of an equalization program. We will conclude by suggesting areas of fruitful additional research on this and related topics.

II. A MODEL OF SCHOOL FINANCE CAPITALIZATION

Any number of models of the determination of housing prices might be consistent with the capitalization of school expenditures and taxes into housing values. The model presented here is probably the simplest, but it does point out the importance of the phenomenon quite clearly.

Assume that housing can be described as a homogeneous commodity, and that the supply conditions in each of three communities are identical and may be represented by curve S. The upward slope of S represents scarcity of housing in any given community. Prices will differ, therefore, as the demand for housing differs in each community. Two questions arise immediately:

- Why do the demands for housing differ?
- How much will they differ in equilibrium?



Two conditions are necessary for demand for housing to differ across communities. First, some communities must be more desirable as residential locations than others, and second, households must be

aware of these differences and be able to take advantage of them by moving to a community in which they will be better off.

Certainly school finance advantages, low tax rates, high expenditures or large concentrations of non-residential taxable property, make some communities better residential locations than others for some households. The empirical evidence presented in the next part of this paper indicates that at least some consumers are aware of these differences when bidding on housing. We can conclude, therefore, that school finance advantages do influence the demand for location in each community.

In order to answer the second question we must first define what we mean by an equilibrium. We will define an equilibrium as a set of prices of housing such that no household can improve its well-being by moving to another community. If a household with given income and tastes could improve its condition by changing places with an identical household in some other community, we assume that it will attempt to do so, thereby bidding up the price of housing in the new community and lowering the price of housing in the old community. Therefore, in equilibrium the prices of housing will differ across communities by just enough so that the well-being of all households with identical incomes and tastes will be the same in all communities in which that type of household lives. *The level of well-being of any given type of household will be determined, not by the fiscal condition (school expenditures and tax rates) of the community in which they happen to reside, but by the fiscal conditions of all of the communities in which they might have chosen to reside.*

These observations have three implications with respect to school finance reform. *First, to the extent that the financial advantages of certain districts are capitalized, the underlying school finance systems are not characterized by horizontal taxpayer inequity.* Much has been made in discussions of school finance of "fiscal disparities." Some districts are observed to spend large amounts per-pupil at low tax rates while others are characterized by low expenditures and high taxes. These data have been taken as prima facie evidence of inequity. The model presented here, however, suggests that households in favored

districts will have paid more for their houses than similar households in less favored districts. If the market generates the kind of equilibrium we have described, the differential in housing prices will just make up for the fiscal advantages.

We do not wish to make too much of this analysis. Capitalization may be imperfect leaving some residual inequity. Furthermore, even though households as a whole may be equally well off, the children of families in low spending districts may be worse off in the long run. What this argument does suggest is that horizontal taxpayer inequities of the sort decried in *Public Wealth and Private Education* (1970) may be less important relative to expenditure inequities than we have been led to believe.

The second implication of capitalization relates to vertical equity. If capitalization is complete, the well-being of any given class of taxpayers will be affected by the relative fiscal circumstances of all the school districts in which they might have chosen to live. *If all households could choose to live in all districts, then the only redistributive effect of reform would be random.* All households in low wealth districts would win, regardless of their initial incomes. All households in high wealth districts would lose.¹ Even if households are segregated by income or race, redistribution would still be random if the distribution of fiscal characteristics across the sets of school districts in which each group could choose to live were identical.²

This suggests that we must look very carefully at the joint distribution of different classes of households and school finance characteristics across school districts before we can determine the direction of the vertical redistribution generated by any given reform.

For example, it has been argued that since the metropolitan poor tend to live in central cities and since central cities tend to be

¹The progressivity of the alternative taxes used to pay for the reform would affect the direction of redistribution. What we claim here is precisely true only for a power equalizing reform which draws nothing from general state revenues.

²Again this is a slight oversimplification. To be precise we must state that the distributions of fiscal characteristics of the sets of districts must bear a specific relationship. (Courant, 1977).

well off by traditional school finance standards, reform might hurt poor people. This argument would not necessarily be true if there were a substantial minority of poor people living outside of the central city (in, for example, East Palo Alto, California or Hempstead, New York or Highland Park, Michigan) and if the suburban poor tended to live in very low wealth districts. Under these latter circumstances a typical school finance reform might help the class of poor homeowners as a whole.

Poor homeowners in the central city will, of course, experience a capital loss, along with all other central city property owners. Suburban poor homeowners will enjoy a capital gain. If state aid to the central city decreases only slightly, while aid to the districts housing the suburban poor increases substantially, poor homeowners as a class may receive a net capital gain.

The third implication of the capitalization effect is more technical than the other two. If a reform program increases spending and decreases taxes in previously disadvantaged districts, property values may be expected to increase in these districts. At the same time the premium on housing in previously relatively advantaged districts will decrease. Once assessed values come to reflect the new market values, underlying disparities in tax bases per-pupil will decline. *Since capitalization effects work in the same direction as equalization, the cost to the state of any given equalization program will be less than would appear to be the case.*

All three of these possibilities will be discussed in more detail after our review of the empirical literature and the presentation of our own empirical findings.

III. REVIEW OF THE EMPIRICAL LITERATURE AND SOME NEW RESULTS

Given the obvious existence of marked disparities in the fiscal conditions of school districts and the soundness of the reasoning behind the theory of capitalization, it would be surprising if we failed to find an empirical capitalization effect. In fact, the extensive econometric literature on capitalization, taken as a whole, tends to confirm the empirical validity of the phenomenon. To be sure, there are some contradictory findings, some overinterpretation of findings and some confusion as to what exactly it is that is capitalized. Furthermore, we have no empirical observations of actual recapitalization following a school finance reform. However, the results of a large proportion of these studies strongly suggest that a reform will bring about substantial changes in relative property values across the school districts within large metropolitan areas.

A. The General Empirical Model

Most of the papers in this literature report regressions more or less of the following form:

$$V_j = \beta_0 + \beta_1 t_j + \beta_2 S_j + \sum_{i=3}^n \beta_i X_{ij} \quad (1)$$

where V_j is some measure of the market value of a house or of the central tendency of market values of all of the houses in jurisdiction j ; t_j is a measure of differential local property taxation in j ; S_j is a measure of public services in j ; and, the X_{ij} 's are a set of other determinants of the value of a house or of the average value of housing. Other papers construct or estimate simultaneous equations systems in which some of the variables on the right-hand side of equation (1) are treated as endogenous. The functional form of equation (1) also varies from paper to paper with different combinations of variables entered as logarithms. Statistical testing focuses on the null hypothesis that β_1 and β_2 are zero and calculations are usually

reported which indicate what percentage of the net present value of any tax increase is most likely to be reflected in a change in property values.

3. The Purposes of the Literature

The authors of these articles have not had school finance reform specifically in mind when undertaking their investigations. Equations of the form of (1) have been estimated for two apparent purposes. Some authors claim to be determining the incidence of that portion of the property tax which differs across communities. They argue (e.g., Hyman and Pasour, 1974) that the proportion of the tax payment stream which is capitalized into the sales price of the property is a good measure of the proportion of the burden of the tax which falls on the supply side of the market. Likewise, Orr (1968) argues that the degree to which contract rent on renter occupied housing varies with differences in local taxation measures the proportion of the property tax burden borne by the demand side.

Other authors estimate equation (1) with some formulation of the Tiebout hypothesis in mind. Tiebout (1956) suggested that well-informed consumers would "shop" for the community offering the package of public services and taxes which most appealed to them. If the number of communities were large, the allocation of public services could be as efficient as the market's allocation of private goods. If this hypothesis is to have any validity at all, it must be the case, at the very least, that consumers are aware of fiscal differences among communities and take those differences into account when deciding on residential locations. Oates originally believed that by finding values of β_1 and β_2 which were significantly different from zero and of the right sign ($\beta_1 < 0$, $\beta_2 > 0$) he had confirmed this weak formulation of the Tiebout hypothesis. Other authors (Edel and Sclar, 1974; Meadows, 1976; Epple, Zelenitz and Vißcher, 1978) have pointed out that the testing of the Tiebout hypothesis is much more difficult an undertaking than Oates suggested.

If these studies could shed light on either the incidence of the property tax or on the validity of the Tiebout model, the results would

have a direct bearing on the analysis of school finance. Reform of school finance is frequently seen as an attempt to reduce the reliance on the property tax as a source of revenues for education. If, in fact, the burden of the property tax falls on property owners and the tax is therefore progressive, then we don't necessarily want to reduce property tax rates on average and substitute general state revenues. If the Tiebout hypothesis is a good description of the world, then a large proportion of the interdistrict variance in expenditure and tax levels is due to differences in the residents' tastes and incomes. If this is the case, then some of the proposed reform instruments will have little effect on expenditure outcomes.

Unfortunately, as we shall demonstrate, these empirical studies shed very little light either on property tax incidence or on the Tiebout hypothesis. Claims to the effect that they do are, in fact, over-interpretations of the findings. However, it is still possible to discern a minimal interpretation of the econometric results and to base our application to school finance analysis on that.

C. Findings: Within a Single Metropolitan Area

Oates originally estimated equation (1) using observations from 53 bedroom communities in northeastern New Jersey. By far the most consistently "successful" (statistically significant values of $\beta_1 < 0$ and $\beta_2 > 0$) estimates reported in the literature have been based on New Jersey data sets (Oates, 1973; Meadows, 1976; King, 1977; Rosen and Fullerton, 1977; Gurwitz, 1977). Various respecifications of either the tax term, the public services term or of the structure of the model itself have resulted in consistent findings of significant tax and service capitalization. However, Pollakowski (1973) has shown that there are reasonable specifications of equation (1) which do not exhibit the expected effects, even for New Jersey data.

Orr (1968, 1970), Heinberg and Oates (1970) and Edel and Sclar (1974) have estimated similar equations for observations from the Boston area. Of these papers only the Heinberg and Oates study is directly comparable with the original Oates paper. The results are similar to those for the New Jersey sample, except that the expenditure term is only barely significant ($t = 1.4$) for the Boston sample.

The dependent variable in the Orr paper was contract rent, not housing values. Orr found a weakly significant public service effect, but could not reject the hypothesis that the coefficient on the tax term was zero. These results, he argued, were consistent with a model in which the full burden of the property tax on rental housing was borne by the supply side. If Orr's results are correct, then the application of the capitalization effect to renter occupants becomes straightforward. Since renters do not bear the burden of local taxation, changes in relative tax rates brought about by school finance reform have no effect on them. Changes in school expenditures, however, are reflected in rents, and therefore, the analysis of expenditure capitalization, and its implications with respect to horizontal and vertical equity, does apply. However, Orr's analysis is methodologically flawed (Heinberg and Oates, 1970), and his study has not been reproduced for other data sets. Therefore, little faith can be placed in these conclusions.

Edel and Sclar were testing a more complex hypothesis than Oates's. In the analytical portion of their paper they argued that in a Tiebout equilibrium we should expect to find no capitalization of taxes or expenditures. Jurisdictions would adjust their budgets in the long run so that no type of community would command the scarcity premium of which capitalization is a reflection. They ran regressions similar to equation (1) for cross-sections of Boston area communities for 1930, 1940, 1950, 1960, and 1970, and divided the public service term into per-pupil educational expenditures and highway maintenance expenditures. They consistently found a significant negative value for β_1 and a declining degree of capitalization of differences in school expenditures over the period from 1950 through 1970. There was no consistent capitalization of highway expenditures. The authors argued that these results provide evidence that the Boston area was approaching a Tiebout equilibrium in education over this period.

Another geographic region which has received considerable attention from researchers in this field is the San Francisco Bay area. Two of these studies produced contradictory results. Both H.O. Pollakowski

(1973) and P.W. Newachek (1978) estimated Oates-type equations for samples of communities in the area. Pollakowski reported that he was unable to find a specification of the regression equation for which the results were similar to Oates's. He was unable to reject the null hypothesis of no capitalization for his sample of 19 municipalities. Newachek, on the other hand, found strongly significant values of β_1 and β_2 of the "right" signs for his larger sample of 47 Bay area incorporated cities. Newachek did not speculate as to why his results differed so markedly from Pollakowski's, so the difference remains a mystery.

All of the studies discussed so far have taken the jurisdiction as the unit of analysis. The dependent variable has been median housing value and the right-hand side variables have been represented by mean values for the locality. One of the studies of the San Francisco Bay area (Reinhard, 1978) was based on observations of individual residences drawn from real estate multiple listing service reports. Essentially, though, he found that both educational expenditures per-pupil and the quantity of educational outputs (as measured by test score changes) exerted positive effects on property values. He also found that the explanatory power of his regression equation reached its maximum when he assumed that 100 percent of property tax differentials were capitalized.

Individual studies of two other metropolitan areas have been reported in the journal literature. A.J. King (1973) reported an elaborate and detailed study of public sector capitalization in the New Haven, Connecticut SMSA. His observations were on individual residences and he constructed sophisticated subjective measures of locational amenities. He found that the tax rate term only carried a significant negative sign in regression equations which attributed all of the effect of covariation between taxes and the quality of services to the tax rate effect.

Gustely's (1976) study of communities in the Syracuse, New York, area found no significant capitalization effect in an Oates-type regression. When he reestimated the equation, this time separating

the tax and expenditure terms into educational and non-educational components, he found some significant patterns of capitalization.

In the course of preparing this paper we were able to estimate an equation like Oates's for a sample of 67 school districts in the Counties of Wayne, Oakland and Macomb, Michigan. We report the results of two stage least squares estimates.

TABLE I

log of Median Housing	= 8.3	
Value, 1970	(5.6)	
	-0.14 (-0.42)	log of 1970 educational tax rate
	-0.65 (-1.25)	log of public school operating expenditures per pupil in 1970
	-0.01 (-0.59)	log of average number of rooms per owner occupied dwelling, 1970
	+0.27 (1.81)	proportion of owner occupied dwellings built since 1960
	-0.003 (-1.92)	log of distance to downtown Detroit
	+0.94 (2.77)	log of median income of school district residents, 1970
	-8.98 (-1.12)	percentage of population in poverty

(t- statistics in parenthesis)

(The tax term and expenditure term were endogenous and the other exogenous variables in the model were county dummies, equalized assessed value per-pupil, percent of population in school, percent in public schools, average educational level of adult residents, percent of residences owner occupied and a measure of the local tax price.)

The results reported here are typical of the findings based on several functional forms. In no case did we find values of $\beta_1 < 0$ and $\beta_2 > 0$ significantly different from zero.

These results are presented not as an attempt to refute the findings of other studies but to show that the character of the empirical results may differ in different metropolitan areas.

D. Findings: Across Metropolitan Areas

While most authors have concerned themselves with the relationship between public sector variables and residential property values across communities within a single metropolitan area, several other researchers have investigated the possibility that the hypothesized relationships might also turn up in samples drawn from across metropolitan areas. Two of these studies were based on samples drawn from jurisdictions within single states. Hyman and Pasour (1973) estimated an Oates-type equation for a data set consisting of 106 municipalities across all of North Carolina. They found no significant tax rate effect, but a positive capitalization of their public service measure, local tax revenues per capita. The authors suggested several reasons why their results differed so markedly from those of Oates and others. The explanations they appeared to favor were that the supply of housing was more elastic in North Carolina than in more densely developed regions and that the variance across communities in tax rates and service levels was small in North Carolina.

McMillan and Carlson (1977) estimated a similar model for a sample of Wisconsin cities. They reported several specifications of the basic regression model. Only in the one which was identical to Oates's did they find any significant capitalization and even there only the expenditure term, and not the tax term, proved to be significant.

Only one study estimated capitalization effects for a nationwide sample. Smith and Deyak (1975) estimated separate equations for the value of owner occupied housing and for contract rent of renter occupied housing using data for a sample of central cities of 85 SMSAs. They found a significant negative effect of differential taxes on housing values and a positive effect on contract rents. The public expenditure term, however, was only significant in the owner occupied equation.

IV. INTERPRETATION OF THE LITERATURE: WHAT IS CAPITALIZED

A. The Problem

While the statistical nature of the empirical results appears to be fairly robust, several authors have pointed out (Hamilton, 1976; Peterson, 1972; Pauly, 1976) that the economic interpretation of these findings is far from straightforward, especially with respect to the "testing" of the Tiebout hypothesis. Oates postulated a weak formulation of that hypothesis, i.e., that households are aware of tax and expenditure differences among communities and take these differences into account when bidding on houses. Hamilton argues that almost *any* values of β_1 and β_2 would be consistent with this formulation of the Tiebout hypothesis.

There is no a priori reason to expect that communities with relatively high per-pupil expenditures will always be scarce enough to command a premium price. It is easy to imagine a metropolitan area in which all but a very few districts levied high tax rates and provided rich educational services. In such an area households with no children would be willing to pay a premium to locate in one of the low-expenditure, low-tax districts. An estimate of equation (1) for such an area would reveal negative values for both β_1 and β_2 . Likewise in a metropolitan area in which most communities had low taxes and expenditures, the high-tax, high-expenditure districts would be scarce and would command a premium. Thus we might find values of β_1 and β_2 both greater than zero. In fact, the only combination of values for β_1 and β_2 which would be patently inconsistent with this weak formulation of the Tiebout hypothesis would be $\beta_1 > 0$ and $\beta_2 < 0$. So these regressions cannot be taken as a "test" of any sense of the Tiebout hypothesis.

Furthermore, the persistence of one pattern of capitalization (e.g., $\beta_1 < 0$, $\beta_2 > 0$), in a single metropolitan area over time requires some additional explanation. If location in a certain type of community commands a scarcity premium, there is an incentive for non-premium communities to try to alter their fiscal package and win a capital gain in land values. We must investigate the underlying behaviors and

institutions to determine what prevents these adjustments from taking place over the long run.

Before we can go on to relate the capitalization findings to school finance analysis we must try to resolve some of these questions. School finance reform is intended, in part, to alter the patterns of scarcity of different types of school districts. In order to predict the distribution of recapitalization effects, we must first know what it is that is scarce, and then see how the reform will alter that scarcity. The remainder of this section suggests one solution to the interpretation problem, formalizes that solution into a simple model and presents some evidence that the solution has empirical validity. The solution we propose has several implications with respect to the interpretation of the capitalization phenomenon and other aspects of the analysis of school finance reform. These implications will be discussed at the conclusion to this section.

B. What Might Be Capitalized

One possible resolution to most of these questions has been suggested by Hamilton (1976). He argued that the observed pattern of results must be a reflection of persistent differences among communities in their comparative advantages as suppliers of public services. If this is the case, locations in such communities will tend to command a scarcity premium. Tax rates in such communities will be lower for any given level of public services and, since the relative price of public services will be lower in the advantaged localities, voters in these communities may be expected to support higher levels of public services than they would have elsewhere. In other words, the observed regression results are a reflection of more basic underlying differences among communities.

Hamilton suggested that comparative advantages might originate in differences in either the efficiency of production of public services or the ability of the jurisdiction to raise revenues.

It is difficult to measure differences in production efficiency across jurisdictions and hard to imagine what factors other than the characteristics of the community's population might explain the

persistence of such differences. When population characteristics, usually median income and percentage in poverty, have been included in the property value regressions, the capitalization effects still remain strong. This argues against the importance of the production efficiency explanation.

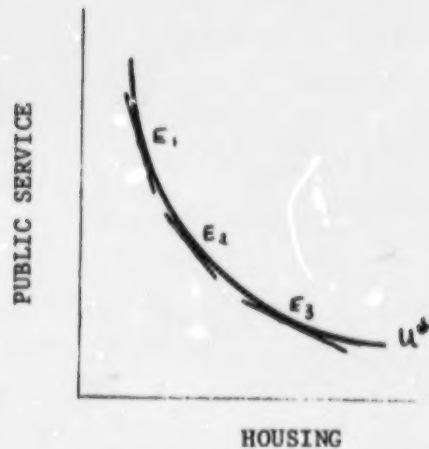
It is much easier to observe differences in the ability of communities to raise revenues. One measure of these differences is the tax price, the dollar cost to a voter/resident of a one dollar increase in public spending. The tax price will differ with the proportion of non-residential property in the local tax base, and this data is available for several U.S. metropolitan areas.

C. A Model and Its Estimation

Assume that housing is less than perfectly elastically supplied in each of several communities, that all households are identical in taste and income and that the communities differ in their underlying ability to provide public services. Communities may differ, for example, in the proportions of non-residential property in their tax bases or in the rates at which some central government will match local revenues. Assume further that all prices, other than the tax price and the price of housing, are invariant with location and that consumer tastes satisfy all of the traditional assumptions. Given the assumptions of identical households and perfect mobility, all households must be equally well off in equilibrium.

If we observe the relative equilibrium prices of public services (the tax price) and housing across communities, we expect to find that all of our observations will lie on the same indifference curve. This expectation is illustrated in Figure 1.

U^* represents the equilibrium indifference curve. E_1 identifies the equilibrium consumption bundle in community 1, the jurisdiction with the greatest comparative advantage in the provision of public services, and, consequently, the highest observed relative price of housing. E_2 and E_3 represent the observed relative prices of public services and housing in two other communities.

Figure 1

The discussion presented here does not constitute a model of the determination of the array of housing prices given an array of public sector comparative advantages. Clearly such a model would have to be a general equilibrium model since the price of housing in any given community depends on the tax and housing prices in all other communities. The discussion presented here claims only that since relative tax and housing prices must represent tangencies of different points on the same indifference curve, they must bear an inverse relationship in equilibrium.

We follow the literature in our specification of the empirical model by regressing median market value on the exogenous determinants of the price of housing and as many measures of the quantity of housing services provided in the community as are available.

The regression equation was estimated for observations on 89 municipalities in northeastern New Jersey. This data set is more extensive than Oates's since it includes observations on localities like Newark, Jersey City, and Patterson which share some of the characteristics of central cities. We have also included one additional quantity variable, the proportion of homes with basements, which was not used by Oates. Finally, we have included a series of county dummies. Since public welfare expenditures were financed on the county level in New Jersey in 1970 and because the same counties (Essex, Hudson,

Union and, to some extent, Middlesex) have substantial welfare populations and large concentrations of non-residential property, leaving these variables out might have biased the coefficient on the tax price term.

The specification of the tax price is something of a problem. If all public services were pure public goods, then the price to an individual household of one dollar's worth of public services would simply be the household's tax share. If we are speaking of per-pupil public school expenditures, the relevant tax price is the household's share of total community taxation divided by the school district's total enrollment. We experimented with several such specifications and found that the R-squared statistic was maximized when we defined the tax price simply as the tax share of the average owner occupant household. This was computed as the percentage of non-apartment residential property in the total tax base in 1970 divided by the number of owner occupied housing units in the jurisdiction as reported in the 1970 census of housing.

One final judgment had to precede empirical estimation. It could be argued that the tax price and the value of housing were jointly determined because, everything else being held equal, the greater the value of the average house, the higher the tax price. However, we have reported results elsewhere (Curwitz, 1977) which indicate that the assessed value of non-residential property includes a substantial random component. If this is true, then the tax price, which depends substantially on that random component, can be thought of as, for the most part, randomly, and therefore exogenously, determined. We therefore adopted ordinary least squares as the estimation technique.

The regression results were:

Median Value of Owner- Occupied Housing, 1970	$\beta_1 = .72$	
	-0.03	Tax price
	(-2.23)	
	+0.09	Mean number of rooms in owner occupied dwellings ¹
	(1.08)	

+0.01	Percentage of units with basements ¹
-0.04 (-2.40)	Percentage of units built since 1950
-0.02 (-0.64)	Distance to downtown New York City ¹
+1.00 (16.18)	Median income of residents ¹
-0.09 (-2.29)	Essex Co.
+0.04 (1.23)	Bergen Co.
-0.07 (-1.25)	Hudson Co.
-0.08 (-2.02)	Middlesex Co.
-0.04 (-1.03)	Morris Co.
+0.05 (1.17)	Passaic Co.
-0.03 (-0.69)	Somerset Co.

R-squared = .91

Before going on to discuss these results, a few apparent anomalies should be mentioned. First, the term representing the newness of the housing stock carries a negative sign. Since newness is generally found to be an amenity in hedonic housing regression, the negative sign requires some explanation. In this region, however, the newness of the housing stock is highly colinear with distance from New York City, and that collinearity might explain the negative sign. Likewise, the insignificance of the distance term is probably attributable to its correlation with age and with some of the county dummies.

¹Entered in logarithmic form. Functional form maximizes R-squared statistic.

The coefficients on the "quantity" terms, basement, rooms and income, are somewhat different from those reported by Oates and others for northeastern New Jersey. It should be remembered, though, that the sample for which this model was estimated is much larger and considerably more diverse than Oates's.

The most interesting empirical result is, of course, the significant negative effect of tax prices on housing values. Through the mechanism of local taxation of business activity, local firms subsidize residents' consumption of public services. It might have been argued that this subsidy is just enough to compensate residents for the negative externalities (traffic, pollution, noise) generated by non-residential activity. These results tell us that this is not the case. Concentrations of non-residential property generate a net fiscal benefit for which households appear to be willing to pay a premium.

D. Some Implications for School Finance

Three inferences relevant to school finance analysis may be drawn from these results. First, we have confirmed the hypothesis that the variables directly affected by school finance reform, relative tax prices, are, in fact, reflected in property values. The recapitalization effects of reform can be analysed without reference to tax and expenditure outcomes.

Second, we see that we know less than we thought we did about the incidence of the property tax. Some of the authors of the empirical capitalization literature inferred, based on their econometric findings, that a substantial proportion of the burden of the property tax falls on the supply side of the market. We see now that the capitalization coefficients are not subject to this simple an interpretation, and are left knowing very little at all about the redistributive effects of a switch from the local property tax to some other revenue instrument.

Finally, the results are suggestive with respect to the relationship between fiscal variables and residential choice. It is difficult to understand the finding of a tax price capitalization effect unless

we assume that consumers are aware of fiscal differences among school districts. If this is so, then there is good reason to believe that households will sort themselves out among school districts with those preferring the largest relative amount of education in the most fiscally advantaged districts.

School finance reformers tend to attribute expenditure disparities to differences in fiscal capacity across school districts. An alternative hypothesis is that most differences in expenditure are attributable to differences in consumer taste and income. If this latter hypothesis is true, then expenditure equality and local control of expenditure decisions are, in fact, mutually incompatible.

Economists would confront these alternative hypotheses by attempting to estimate the tax price elasticity of demand for educational expenditures. An inelastic demand curve would indicate that income and taste differences, but not prices, drive expenditure disparities. We have shown that this methodology is suspect since price effects and taste or income effects will be confounded. Again, we must conclude that evidence for an elastic demand curve notwithstanding (Feldstein, 1975; Ladd, 1975), we do not know the source of expenditure disparities.

V. CAPITALIZATION AND HORIZONTAL TAXPAYER EQUITY

We have argued that if capitalization is perfect, then, by definition, all identical households must be equally well off. If, however, there are barriers to residential mobility for some groups of households, capitalization effects will not be observed across houses occupied by these groups, and members of these groups who live in low wealth districts will be worse off than identical households in high wealth districts. The degree of horizontal inequity of the finance system is measured by the degree to which fiscal differences are reflected in housing prices.

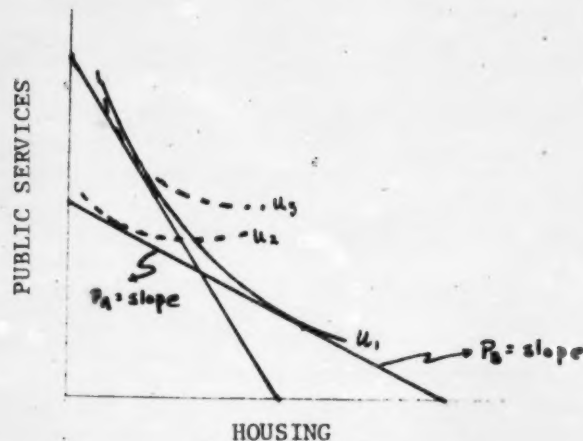
Previous authors have tended to identify perfect capitalization with a 100 percent capitalization of tax bill differences in the price of housing. Given the alternative conceptualization of capitalization presented in the previous section we see that it is impossible to tell whether capitalization is complete. We can only tell whether or not any capitalization takes place at all.

Our empirical work tells us whether or not there is an inverse relationship between the tax price and the price of housing. If there is no observed relationship, that is, if our capitalization coefficients are not statistically significant, then we can conclude that the market does not compensate homeowners in fiscally disadvantaged school districts. The absence of capitalization effects, therefore, provides evidence for horizontal inequity.

Suppose, however, that we do find a significant inverse relationship between the tax price and the price of housing. For example, suppose we find that in two communities, A and B, the relative tax and housing prices are $PHA/PTA = PA$ and $PHB/PTB = PB$. This would mean that for a consumer with given income the budget lines associated with residence in each of the communities are as in Figure 2. These budget lines are simply projections of the observed relative prices at the tangency with the indifference curve. Since housing is inelastically supplied and since all consumers are identical, the actual budget lines for each community are non-linear. For purposes of this argument,

however, it is simply necessary to show that the observed relative prices are consistent with several interpretations.

Figure 2



The indifference curves drawn in Figure 2 illustrate the argument. The solid and broken lines represent two different utility functions. If the relative prices are P_A and P_B and if U_1 represents the true utility function, then there is no horizontal inequity. However, it is easy to draw a set of indifference curves such as U_2 and U_3 which are consistent with our observations, but which reflect horizontal inequity. If we call the situation with U_1 "perfect capitalization" and that with U_2 and U_3 "imperfect capitalization" we see that the two cases are empirically indistinguishable. In order to tell whether capitalization were complete we would have to have information on consumer taste. Since tastes are unobservable we could never tell the degree to which horizontal inequities characterize the school finance system. We can, however, dismiss the argument that fiscal disparities constitute *prima facie* evidence for horizontal inequity, at least for those metropolitan areas which exhibit significant capitalization effects.

Our analysis in this section has two implications with respect to school finance analysis. Only if there is no measurable capitalization

do fiscal disparities constitute prima facie evidence of horizontal taxpayer inequity. The evidence we have tells us that this is the least likely case. We must therefore investigate the issue of horizontal inequity more closely. Since partial and complete capitalization are empirically indistinguishable given only observations of housing values, we cannot rely solely on capitalization studies to provide information on horizontal inequity.

However, our analysis does tell us that the sources of whatever horizontal inequity exists are barriers to residential mobility. The pervasiveness of racial discrimination and minimum lot size zoning suggest that such barriers are substantial. However, in many metropolitan areas all categories of households still have substantial numbers of alternative possible residences. Furthermore, since the choices available to a household, regardless of its socio-economic status, are likely to include both high and low wealth school districts, it is possible that the existing barriers to mobility are irrelevant from the point of view of school finance.

The degree of residential mobility and the characteristics of each household type's choice set are empirical questions. Our analysis tells us that these are the crucial empirical issues in any attempt to discern the degree of horizontal equity of a school finance system.

VI. CAPITALIZATION AND VERTICAL EQUITY

The limited scope of this Note precludes an extensive discussion of this issue. However, a cursory analysis of some of the data used elsewhere in this Note can provide some information about the likely vertical redistributive effects of a "typical" reform.

If changes in property values follow school finance reform, then part of the private benefits of the reform will take the form of capital gains and losses to property owners. When the relative fiscal position of previously disadvantaged localities improves, property owners in those jurisdictions will enjoy capital gains. Property owners in previously advantaged communities will experience a capital loss. Furthermore, the log-linear functional form of equation (1), which most researchers in this field have used, suggests that the gains experienced by homeowners in a single community will be, roughly speaking, a constant proportion of the market value of their home. Therefore, we can estimate the distribution of expected capital gains among homeowners by observing the joint distribution across localities of aggregate property values owned by each income class and the relative fiscal condition of the locality before the reform. Likewise, we can get a rough indication of whether the class of owners of investment properties are likely to receive net capital gains or losses by observing the correlation between aggregate non-residential property values and relative fiscal advantage before reform across localities.

In the table which follows we measure relative fiscal advantage by equalized assessed value per-pupil. Income classes are defined as the sets of households with census income below each of several levels. Property owners in communities with the lowest assessed value per-pupil can be expected to experience the greatest proportional capital gains as a result of school finance reform. We report the correlation between assessed value per-pupil and the aggregate value of owner-occupied property owned by households with census income below several levels and with the aggregate value of investment property.

TABLE II

CORRELATION BETWEEN AGGREGATE PROPERTY VALUES
BY OWNERSHIP CLASS AND EQUALIZED
ASSESSED VALUE PER-PUPIL

Aggregate Value of Owner-Occupied Housing Owned by Households With 1979 Income Less Than	Correlation with EQUALIZED VALUE PER PUPIL	
	Northeastern ¹ NEW JERSEY	Southeastern ² MICHIGAN
\$3,000	-0.008	-0.0008
\$5,000	-0.01	-0.004
\$7,000	-0.007	-0.006
\$10,000	-0.09	-0.01
\$15,000	-0.08	-0.03
\$25,000	-0.06	-0.02
Aggregate Value of Non-Owner Occupied Property	-0.006	.08
Number of Observations	106	82

¹Coterminous school districts and municipalities in Bergen, Essex, Hudson, Middlesex, Morris, Passaic, Somerset, and Union Counties.

²School districts in Wayne, Macomb, and Oakland Counties, exclusive of Detroit.

The important finding revealed in Table II is that all of the correlations are close to zero, and, in fact, the null hypothesis that all correlations are zero cannot be rejected at any standard level of significance. This means, quite simply, that in these two metropolitan areas the capital gains and losses associated with any school finance reform that distributes aid in inverse proportion to equalized assessed value per-pupil will be entirely random across these income classes. Homeowners within any income class are as likely to lose as to gain. Owners of investment properties are as likely to lose as to gain.

These results are, of course, of very limited generalizability. The joint distributions of fiscal advantage and resident incomes may differ markedly in other metropolitan areas. Also, we have said nothing about the private benefits which might accrue to renters. However, these findings do suggest that the vertical redistribution associated with school finance reform is not necessarily progressive. Detailed investigation of each reform proposal in each state is required before any conclusion can be drawn.

VII. CAPITALIZATION AND THE DIRECT COST OF EQUALIZATION

Capitalization effects influence the cost as well as the benefits of school finance reform.

Since school districts which were previously characterized as "low wealth" will receive the bulk of the new state aid, most capital gains will be in these districts. As the property wealth of the school district increases in low wealth districts and decreases in high wealth districts, tax bases will tend to become more equal. So, since the recapitalization effects work in the same direction as the aid program itself, a "smaller" reform might go farther toward meeting any given tax base equalization goal that might have been expected had capitalization effects not been taken into account.

A first order linear approximation of the capitalization effects which might follow a school finance reform suggests that property value changes might be substantial and their effect on the cost to the state of any given degree of tax base equalization might be considerable.

Oates found that a balanced budget increase in local taxes and per-pupil expenditures had a negligible net effect on property values. This might easily mean that an exogenous increase in state school aid would have the same effect on property values in a school district regardless of whether the additional money was used to increase expenditures or to decrease local taxes. So if the state institutes a school finance reform which allocates D_i new state aid dollars per year to school district i , leaving the ex ante distribution of "old" state aid the same, we might expect property values to increase in that district by $\frac{\alpha D_i}{\rho}$ dollars, where α is the proportion of a tax decrease which is capitalized and ρ is the rate of return on real estate investments.

Now consider the case of a typical guaranteed tax base school finance program, and assume that the state's objective is to assure each district the equivalent of a tax base of G dollars per-pupil. How much is such a program likely to cost the state? If we do not

take the capitalization phenomenon into account, we might expect that the aid to be sent to district i would be:

$$D_i = t_i \left(G - \frac{AV_i}{P_i} \right) P_i \quad (2)$$

$$= t_i (GP_i - AV_i) \quad (3)$$

where P_i is the enrollment in district i , and AV_i is i 's total assessed value and t_i is the district's tax rate.

However, if the residents of the district expect to receive D_i new dollars per year forever, then property values will increase, and when this increase is reflected in assessed value, the new figure will be

$$AV_i' = AV_i + \frac{\alpha D_i}{\rho} \quad (4)$$

and state aid to the district will be reduced. How much, therefore, would it cost the state over the long run, to assure each district the equivalent of G ? The lower state aid figure, D_i' , will be the solution to:

$$D_i' = t_i \left(G P_i - AV_i' - \frac{\alpha D_i'}{\rho} \right) \quad (5)$$

$$D_i' \left(1 + \frac{\alpha t_i}{\rho} \right) = t_i (G P_i - AV_i') \quad (6)$$

$$D_i' = \frac{t_i (G P_i - AV_i')}{1 + \alpha t_i / \rho} \quad (7)$$

If we compare (7) and (3) we see that

$$D_i' = \frac{D_i}{1 + \alpha t_i / \rho} \quad (8)$$

If we take .03 (30 mils) as an approximation of a typical t_1 , .05 as an estimate of ρ , and adopt Oates's conclusion that 60 percent of differential property taxes are capitalized, we find that

$$D_1' = .74 D_1.$$

In other words, if we take recapitalization effects into account, the additional direct cost to the state of a guarantee of any given tax base might, as a rough approximation, be 25 percent less than would have been expected. The greater the proportion of differential taxes capitalized into property values, the higher the typical rate and the lower the rate of return, the greater the approximate savings.

The guaranteed tax base plan is an atypical reform. Only a few states have adopted it. However, the general analysis presented here applies to any reform plan in which local expenditures continue to rely in part on the size of the local tax base.

Unfortunately this rough approximation is likely to be extremely inaccurate. The problem is that it is not the fiscal condition of any given jurisdiction *per se* which is reflected in the price of housing, but rather the fiscal condition of each community relative to that of the other communities in the metropolitan area. The coefficient estimates of equation (1), upon a rough characterization of which we based our derivation of equation (8), reflect conditions in the "average" community in the metropolitan area, given the entire range of tax rate-expenditure packages in the metropolitan area as a whole. As large an institutional change as a school finance reform will presumably change the tax-rate/service-level package in a great many communities, and, therefore, there is no reason to expect that the coefficient estimates in equation (1) based on post-reform data would be at all similar to estimates based on pre-reform data.

VIII. CONCLUSIONS AND A RESEARCH AGENDA

A. Policy Implications

School finance reform is generally seen to have two related, but distinct objectives: expenditure equity and taxpayer equity. Occasionally these goals are in competition for the attention of analysts, courts and legislatures. The empirical finding of significant capitalization effects together with an analysis of their implications confounds the question of taxpayer inequity considerably.

Furthermore, the capitalization evidence lends indirect support to the belief that expenditure differentials across school districts are more the result of taste and income differences than of fiscal capacity disparities. To the extent that this is true, local control and socially optimal expenditure patterns are irreconcilable.

So the capitalization phenomenon makes the task of school finance reformers at once easier and more difficult. Decreased certainty about taxpayer inequities allows legislatures and courts to concentrate on expenditure disparities alone. However, if desirable expenditure patterns can only be induced by direct centralized control, the political and economic efficiency costs of reform are larger than we originally expected.

B. Future Research

The results we have here are only suggestive. They tend to push our conceptualization of school finance issues slightly in one direction or another.

Since the empirical and theoretical issues involved are crucial, further effort along these lines is an essential element of a school finance research agenda.

Several specific topics call for immediate attention. First, a major lacuna in our argument is that we have no evidence that recapitalization will follow reform. We know that the fiscal disparities of the current system are reflected in land values. However, we have no empirical evidence of actual changes in property values following

reform. Several states have instituted major reforms over the past decade, and data on housing values and characteristics in these states could be gathered and analysed.

Second, as we pointed out at the beginning of this note, we know very little about how capitalization affects renters. Consideration of this population segment requires somewhat more complex analysis than the owner-occupant case. However, the problem is far from intractable; the necessary data is available; and, our understanding of important issues will be incomplete unless we close this lacuna.

Third, we have shown that the issue of taxpayer inequity depends crucially on the presence of barriers to residential mobility. The impact of these barriers on households' school finance opportunities should be investigated. This topic could be dealt with directly by observing mobility patterns of different types of households among school districts. Alternatively, we might investigate capitalization patterns in different segments of housing markets. We might find that while high income housing values exhibit capitalization effects, housing for Blacks or low income households does not exhibit these patterns.

Finally, we have pointed out the need for detailed investigations of the joint distribution of fiscal advantages and resident income. Empirical information along these lines applied to an analytic model of consumer choice would help determine the impact of reform on vertical equity.

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